Sustainability of the Socioeconomic-Ecological Systems (SES) along the Silk Road

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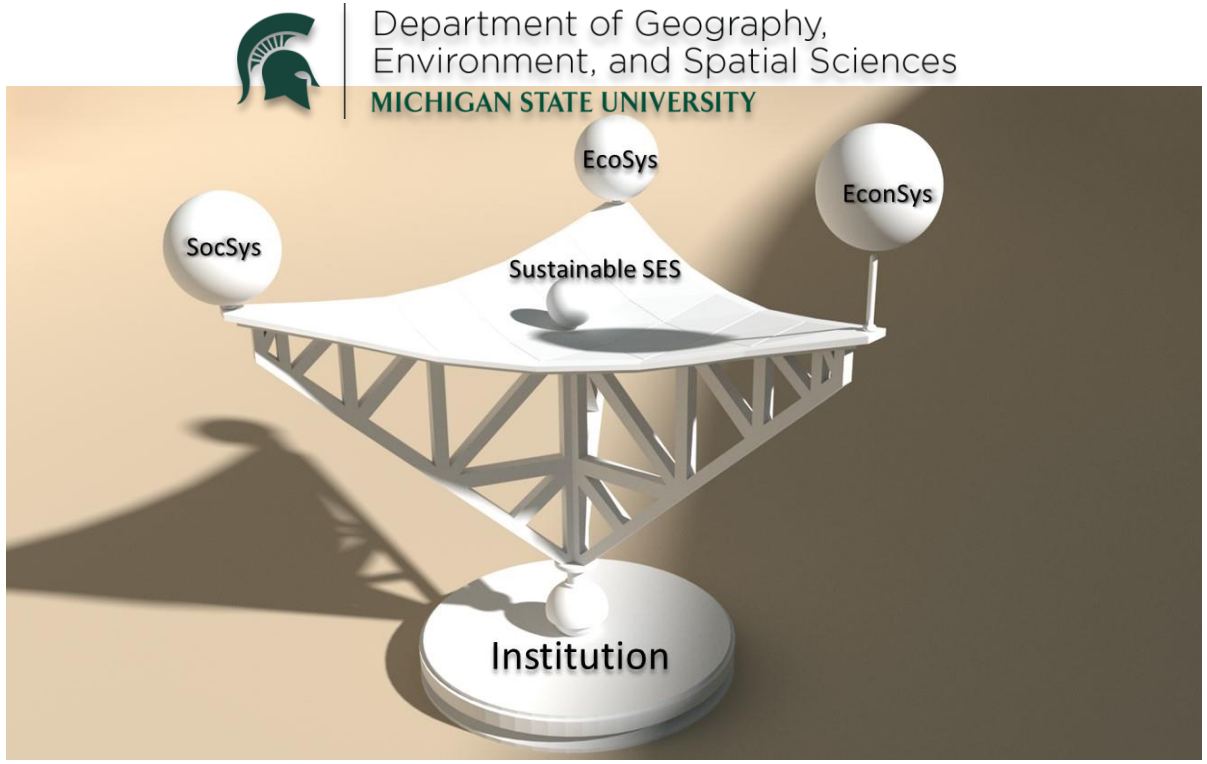
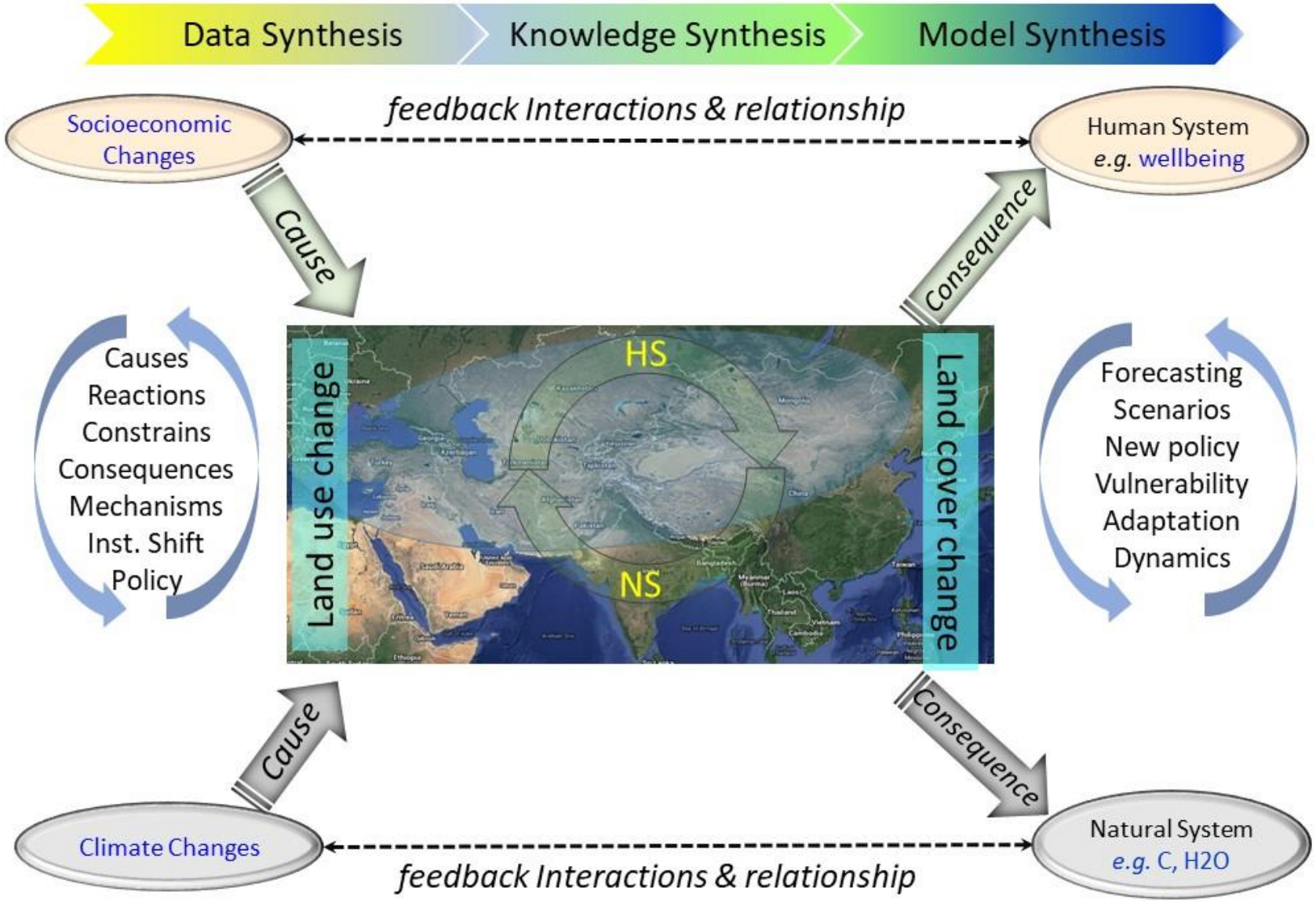
(MSU, CAAS, USD, SU, NCSU/NOAA)



USCCC Annual Meeting
July 26, 2019

Drivers and Functions of Asian Drylands Belt (ADB) through the lens of Socioeconomic-Environmental Systems (SES)



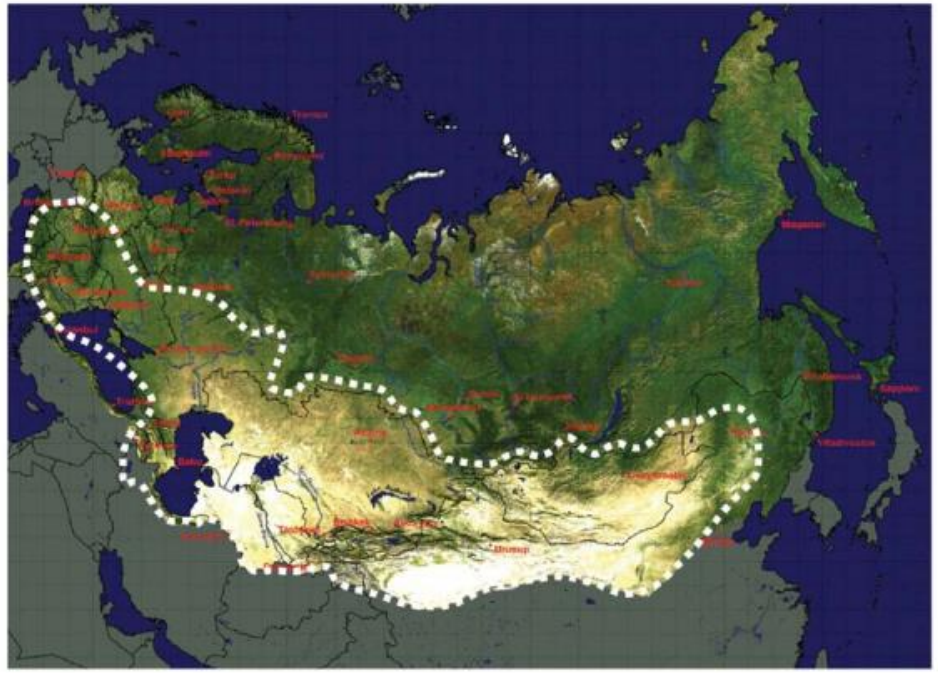
Study Region: The Asian Drylands Belt (ADB)

Chen, J., Z. Ouyang, R. John, G. M. Henebry, P. Groisman, A. Et al. (2019). Social-Ecological Systems across the Asian Drylands Belt (ADB). In Gutman et al. (Eds.), *Land-Cover and Land-Use Change in Drylands of Eurasia*, Springer

Groisman, P., Bulygina, O., Henebry, G., Speranskaya, N., Shiklomanov, A., Chen, Y., ... & Dufour, A. (2018). Dryland belt of Northern Eurasia: contemporary environmental changes and their consequences. *Environmental Research Letters*, *13*(11), 115008.

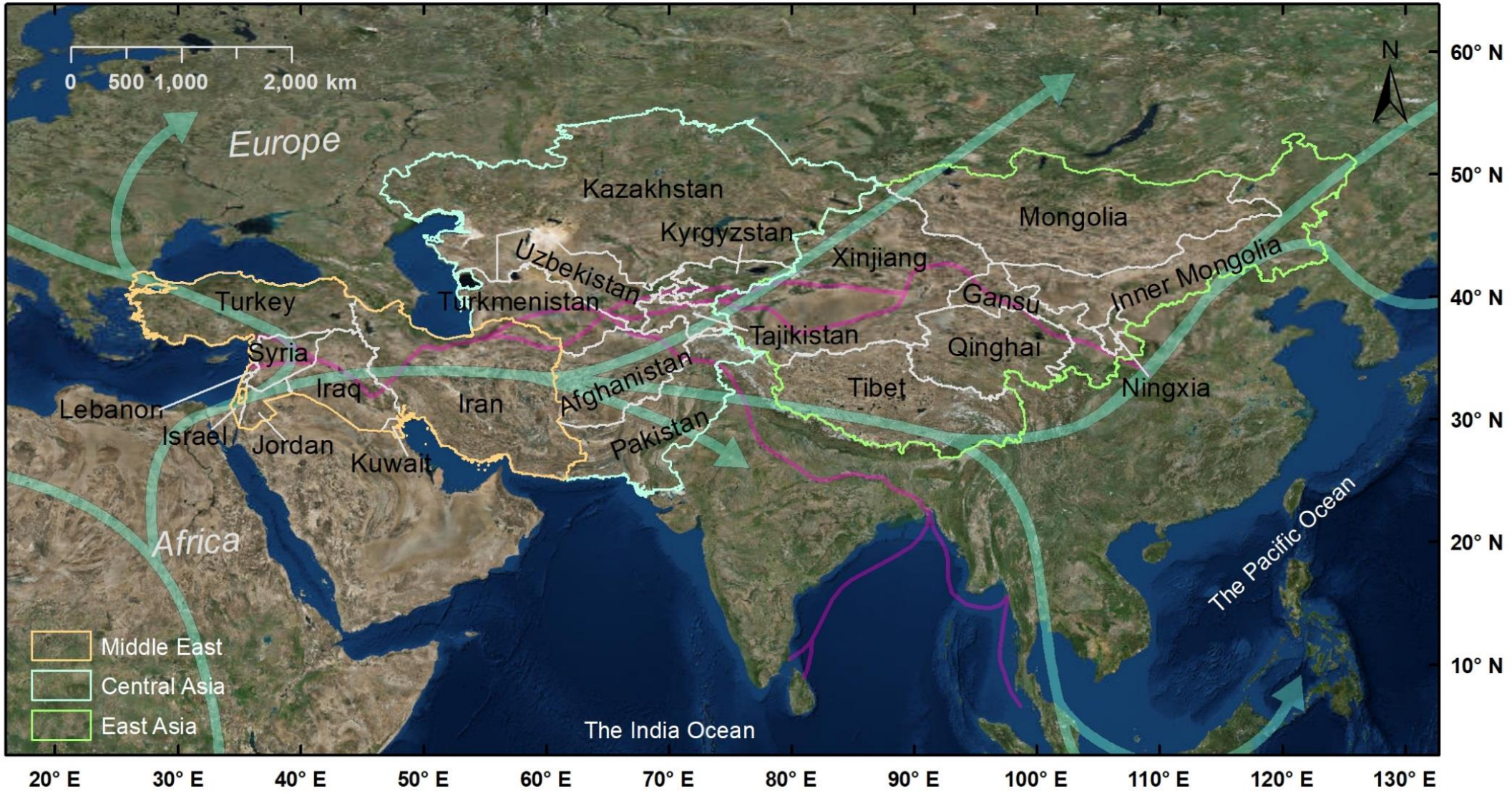
Qi, J., Xin, X., John, R., Groisman, P., & Chen, J. (2017). Understanding livestock production and sustainability of grassland ecosystems in the Asian Dryland Belt. *Ecological Processes*, *6*(1), 22.

Chen, J. and others. (in preparation). Rises and Falls of the Socioeconomic-Ecological Systems along the Silk Road. *Nature-Sustainability*

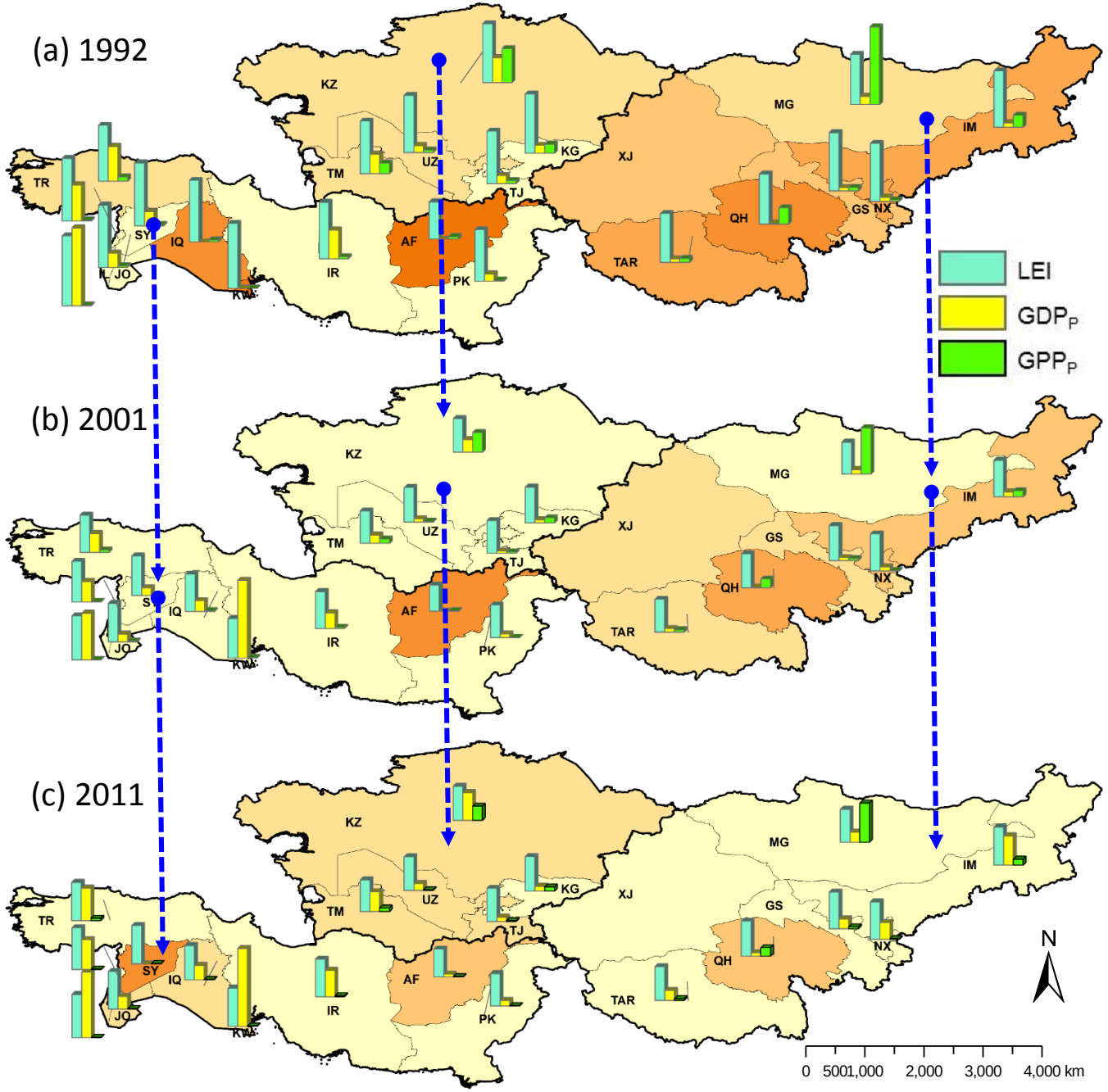


Groisman, P., Shugart, H., Kicklighter, D., Henebry, G., Tchebakova, N., Maksyutov, S., ... & Prishchepov, A. (2017). Northern Eurasia Future Initiative (NEFI): facing the challenges and pathways of global change in the twenty-first century. *Progress in Earth and Planetary Science*, *4*(1), 41. -- the PEPS Most Cited Paper Awards 2019

Study Region: The Asian Drylands Belt (ADB) that include 17 countries in 22 political entities. It is also loosely called "The Silk Road" -- the terrestrial routes connecting East Asia and Southeast Asia with East Africa, West Asia and Southern Europe.



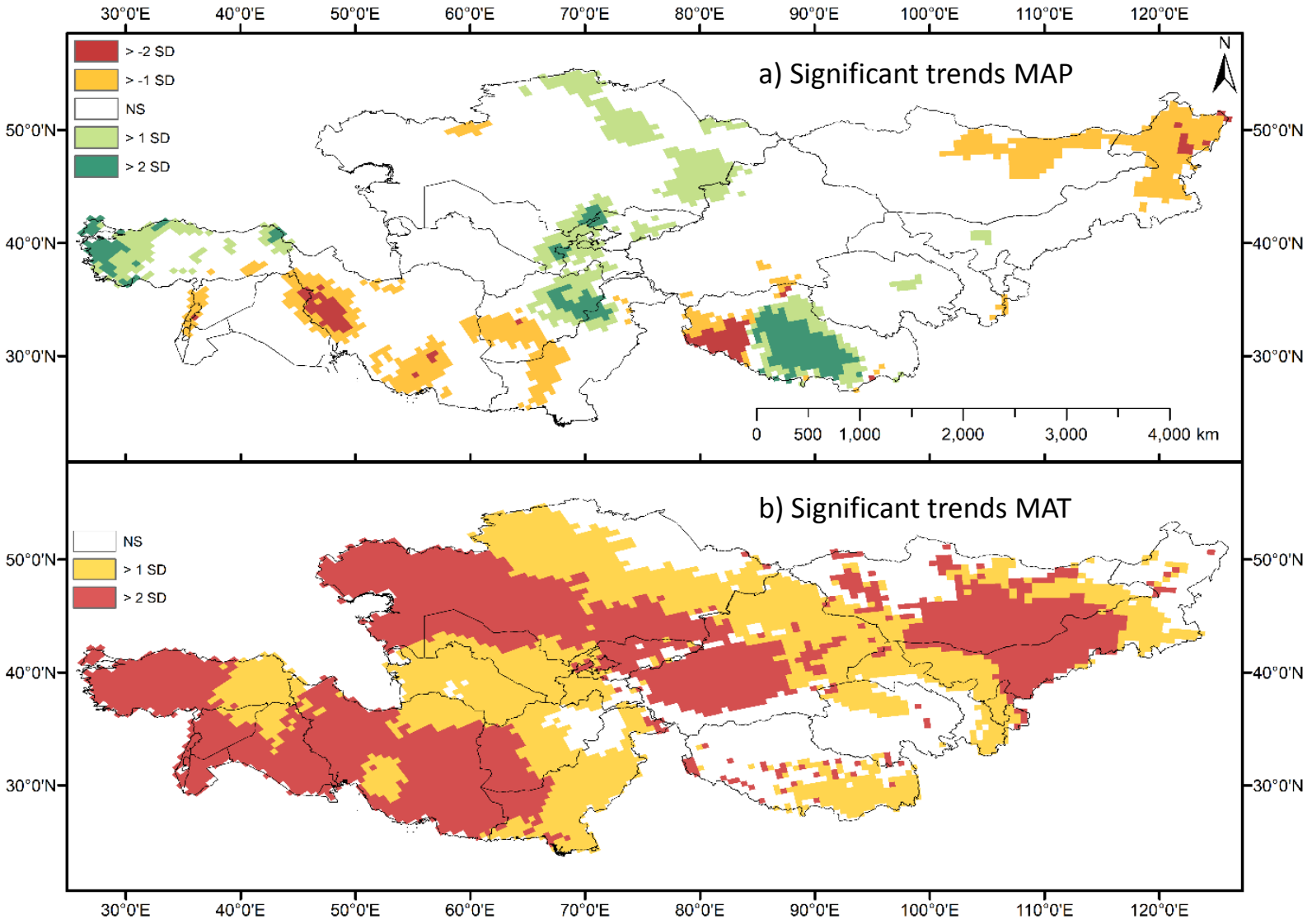
Sustainability Index (SI) of the 22 political entities in 1992, 2001, 2011 (2017 is being updated!)



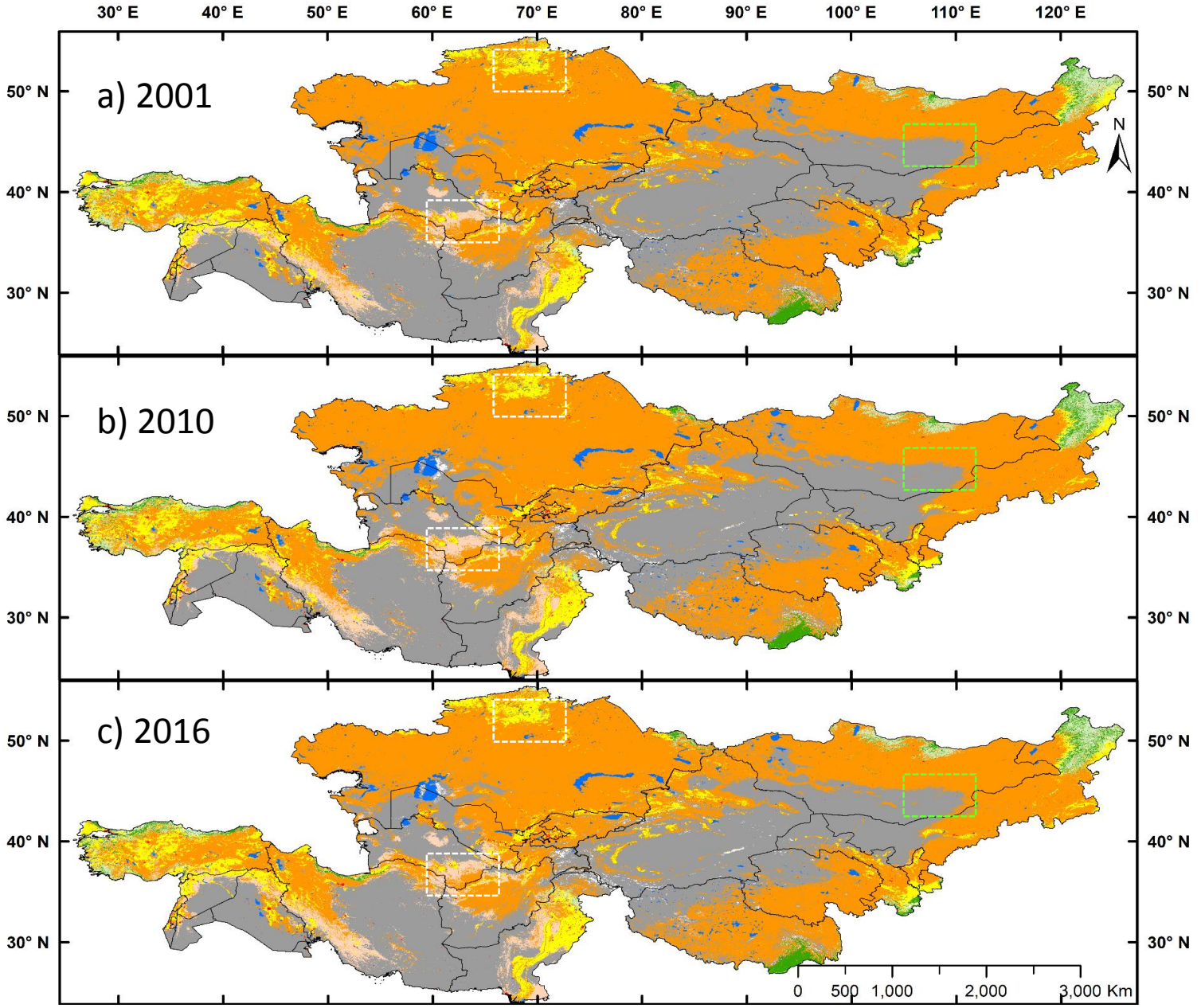
SI

	0.00 - 0.10
	0.11 - 0.20
	0.21 - 0.30
	0.31 - 0.40
	0.41 - 0.50
	0.51 - 0.60

Climatic change and the spatial variability (e.g., hotspots)



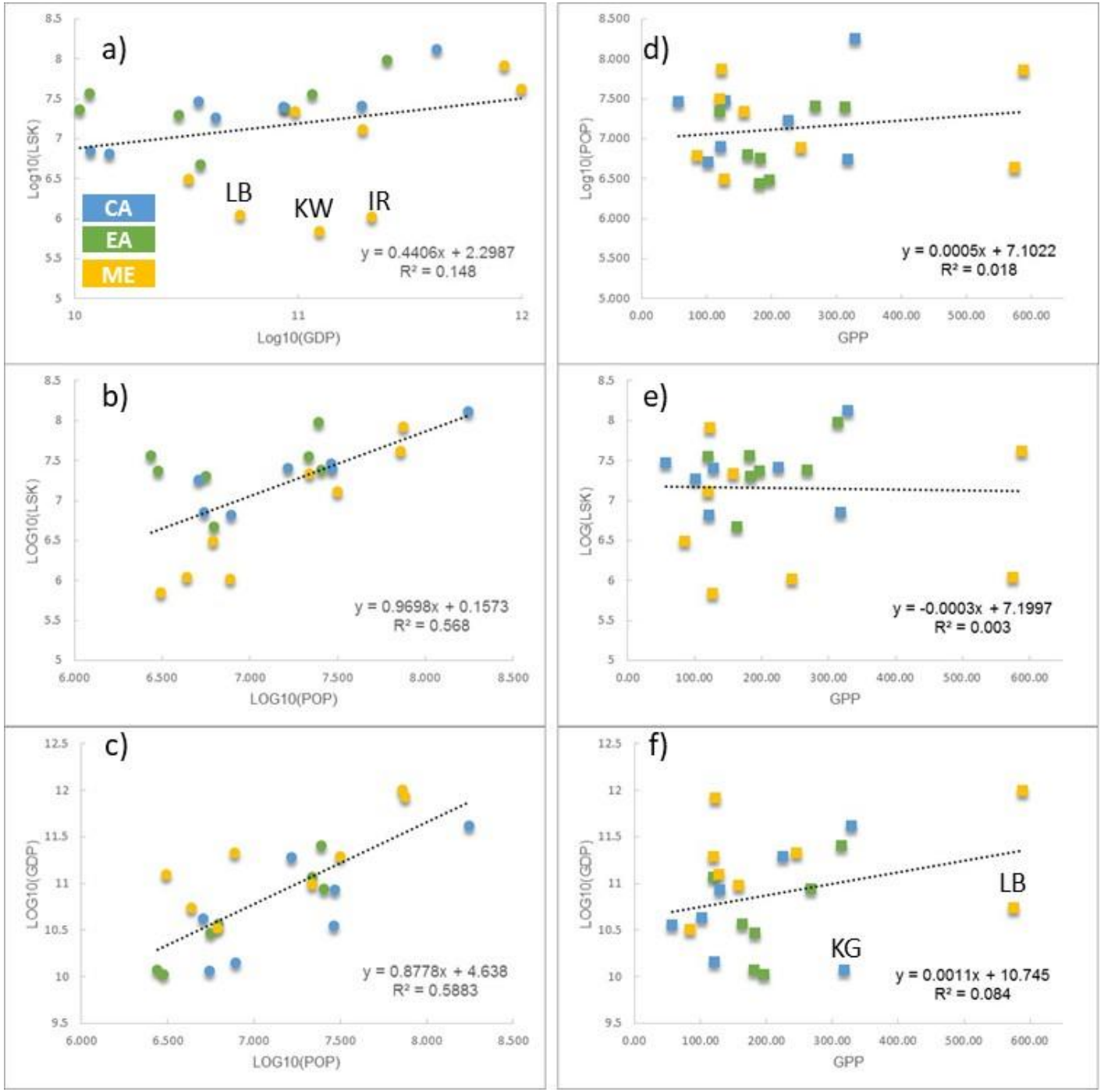
Land cover and land use changes across ADB.



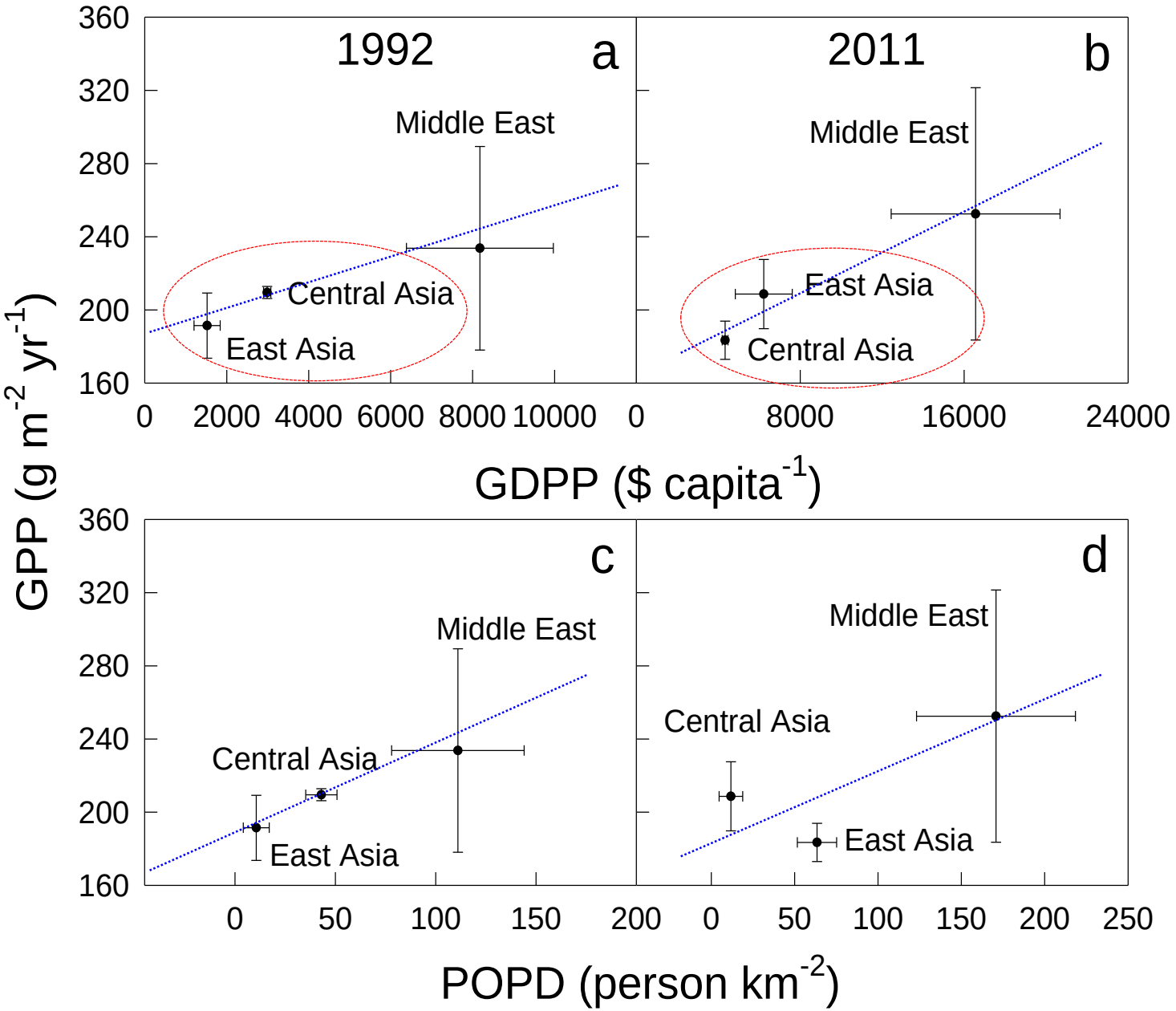
Forest
Savanna
Wetland
Urban
Water
Shrubland
Grassland
Cropland
Barren

Interrelationships among SES indicators

1) Are society functions dependent of natural functions (e.g., Fig. d-f)?
2) Would population/economic increases affect ecosystem function and agricultural productions?
3) What are the differences among ADB countries?
4) Others?



The interdependency at regional level



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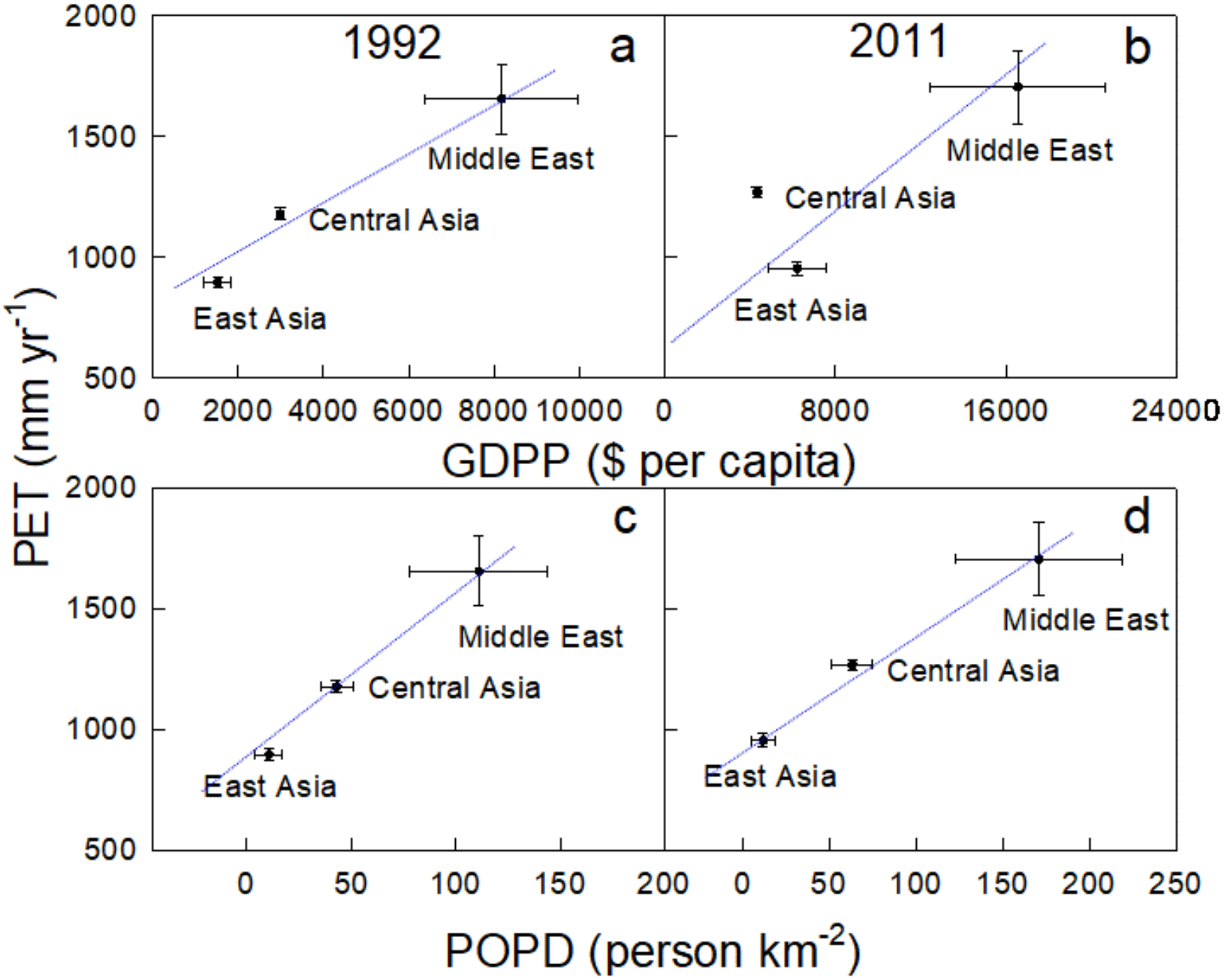
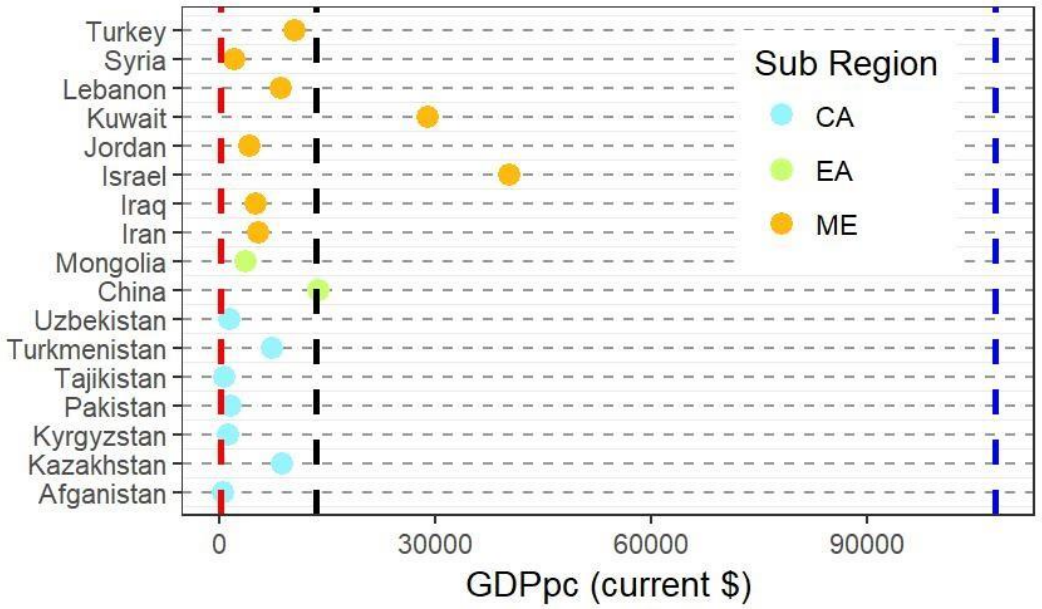
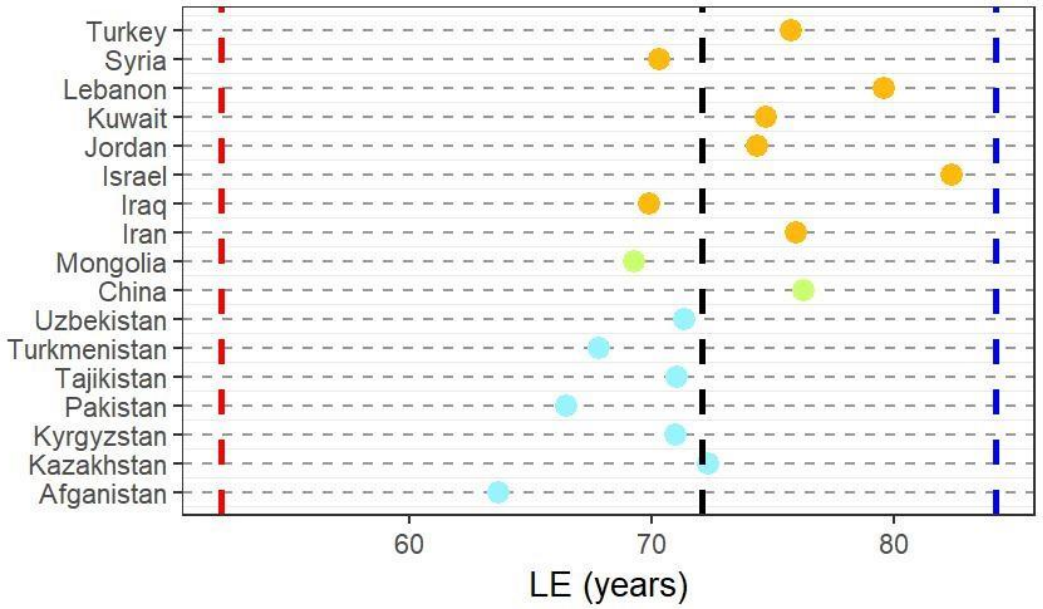
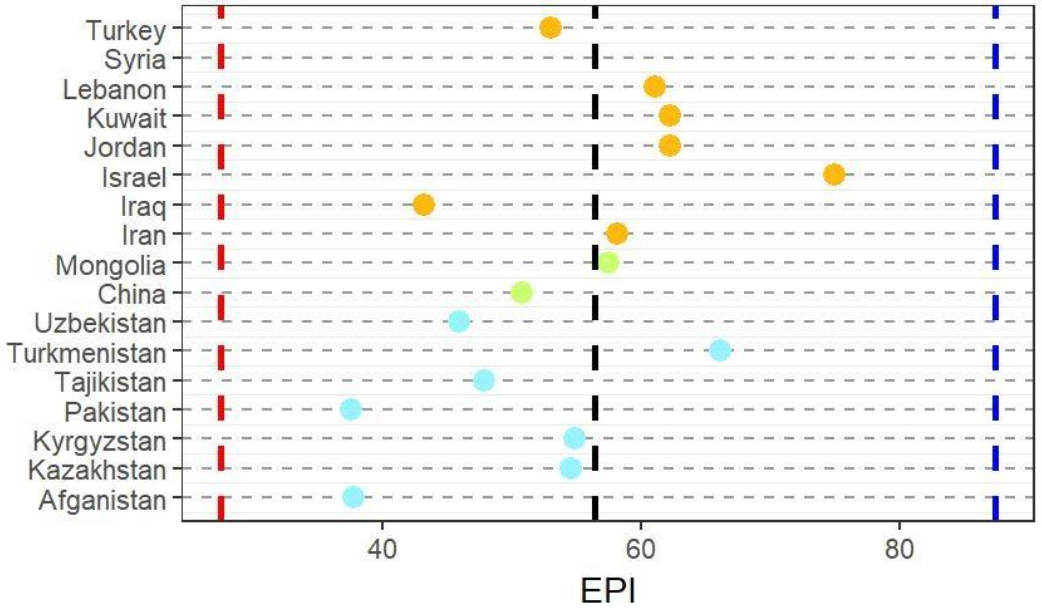
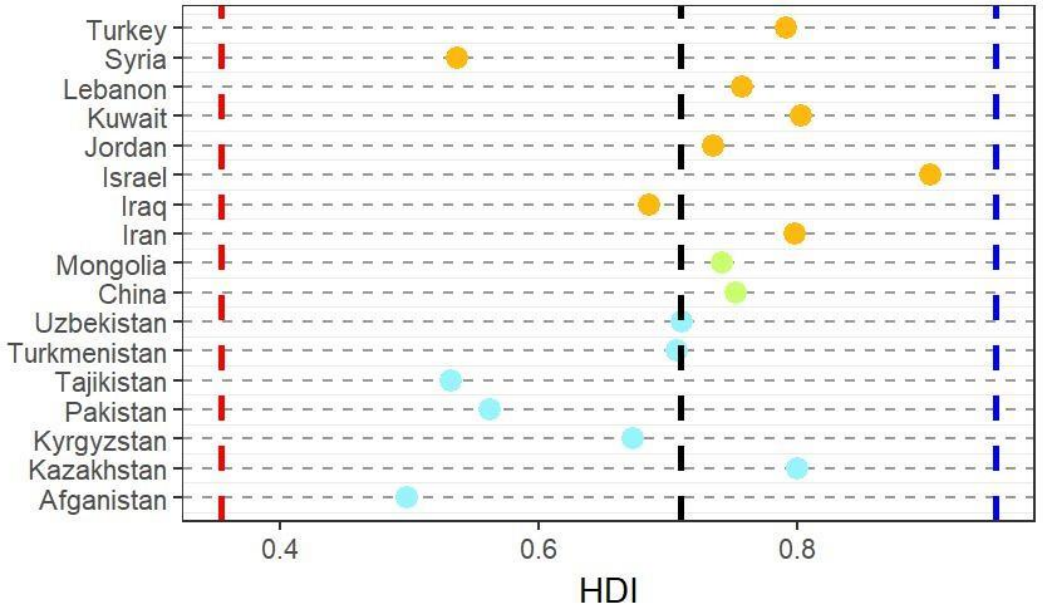


Sustainability of the 22 political entities in 2015 within the ADB



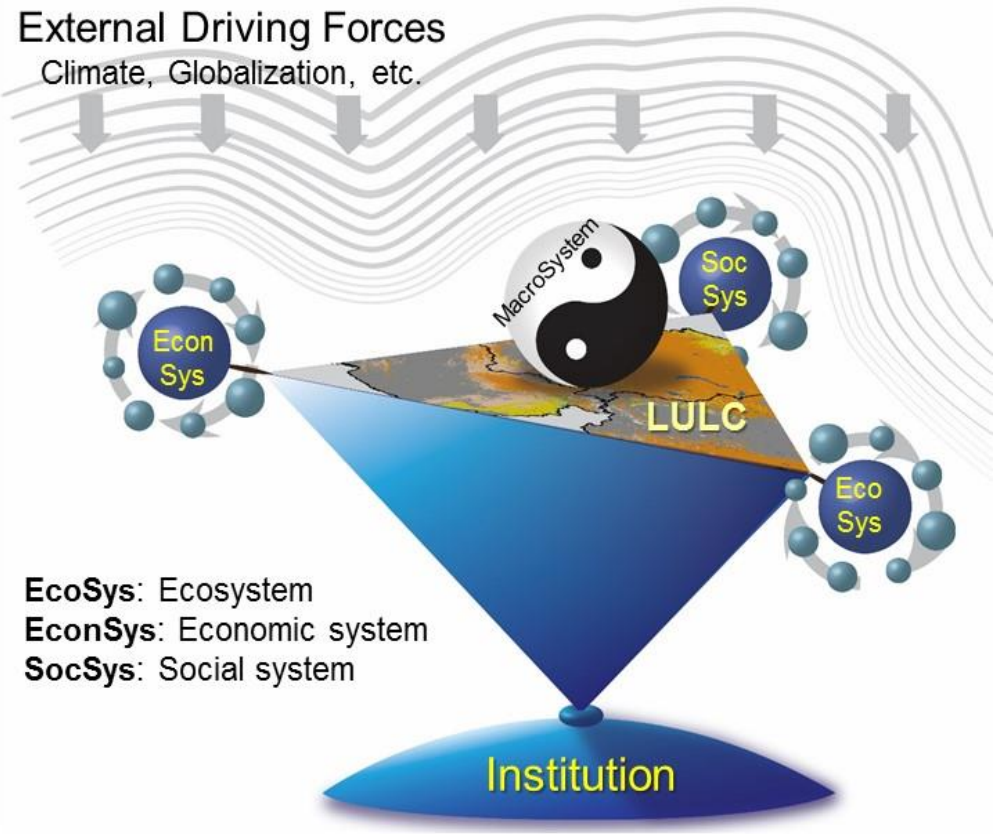






Take-Home-Messages

- Taking a macrosystem approach, we examine the interrelationships among SES indicators by comparing three sub-regions: Drylands East Asia (DEA), Central Asia Core (CAC), and the Middle East.
- The five pressing issues facing the future sustainability of SES may include:
    1) water scarcity
    2) intensified land use and land cover changes
    3) climatic extremes and climatic change
    4) globalization and cross-country effects
    5) unforeseeable institutional changes and shifts
- Institutional structure and changes are essential foundation for understanding and modeling SES.



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Stay tuned for more information at: http://lees.geo.msu.edu/

Questions: